Marshall Space Flight Center

Technology Opportunity

Ternary Gas Plasma Welding Torch

The National Aeronautics and Space Administration (NASA) seeks to transfer the NASA-sponsored Ternary Gas Plasma Welding Torch technology to private industry for use in commercial applications. This device was developed by Lockheed Martin, for the George C. Marshall Space Flight Center, to provide a faster, more efficient means of joining thicker materials with relatively low heat inputs. In addition, due to the patented design, there is less dependency on the technician's skills to achieve quality results. The increase in performance that the Ternary Gas Plasma Welding Torch achieves is attributed to a secondary inert gas acting in conjunction with the primary inert gas to provide a substantially "stiffer" arc from the electrode of the torch than a typical single inert gas provides.

Potential Commercial Uses

The Plasma Welding Torch can benefit any process that requires continuous welding where precision, speed and weld strength are essential. The NASA innovation is a more cost effective alternative to laser or electron beam welding. Products produced from aluminum alloys are prime candidates for the Torch. Product examples include pipes, tubes, valves, cans, tanks and other containers, and engine components. Industries for potential application include automotive, aerospace/aviation, ship building, and industrial machinery.

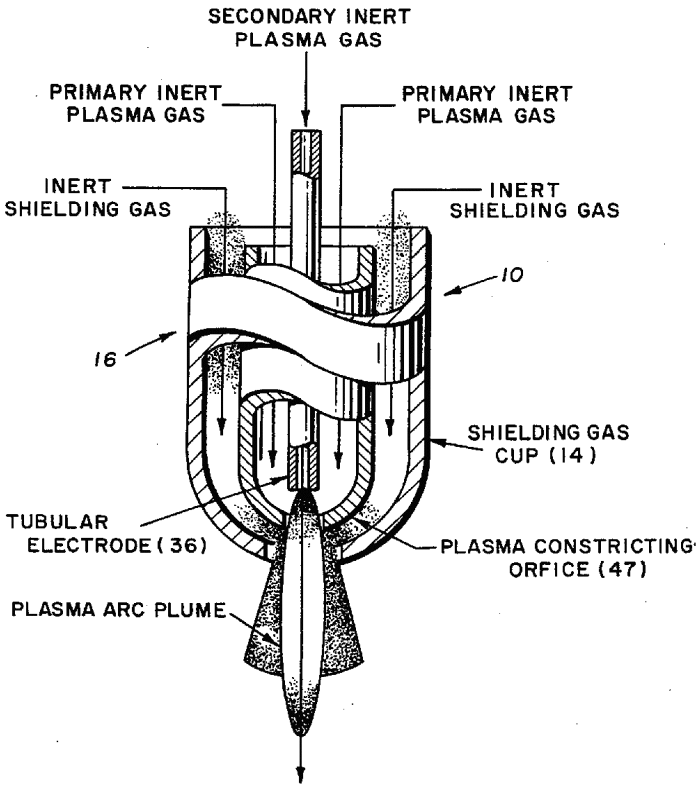
Attributes

- Improves weld quality through a stiffer more controllable arc
- Reduces cost through reduction in weld "cutting" defects
- Reduces welding times
- Narrower weld with greater penetration at any given electrical current setting
- More desirable Heat Affected Zone (HAZ)
- Reduces dependency on operator's skills
- Expands the capabilities for joining thicker materials with relatively low heat inputs.

The Technology

The Ternary-Gas Plasma Arc Welding (TGPAW) torch functions by utilizing three gases, a primary inert plasma gas, a secondary inert plasma gas, and an inert shielding gas. The primary inert plasma gas is directed through the body of the welding torch and out of the body across the tip of a welding electrode disposed at the forward end of the body. The second plasma gas is disposed for flow through a longitudinal bore in the electrode. It is directed through the electrode to coact with the arc to produce equivalent defect free welds in types and thickness of metals (ferrous and non-ferrous) with less total heat input per inch of weld (i.e. less current/voltage output and/or high travel speeds). The completed weld is more narrow with greater penetration at any given electrical current setting, thereby producing a more desirable Heat Affected Zone (HAZ) and greater ultimate tensile strength values. In addition, the secondary inert plasma gas compliments the primary inert gas to provide a "stiffer" arc, less subject to becoming skewed and unequal in dimensional shape. This characteristic aids

alleviating weld "cutting" defects caused by an asymmetrical arc and subsequent asymmetrical heating pattern at the weld joint. The secondary plasma gas may be any of the inert gases or semi-reactive gases or a mixture of two or more of these, however the choice is dependent on the material being welded and the results desired. The process can be applied to Direct Current Straight Polarity and Variable Polarity Welding Modes. The third inert plasma gas is "shield" gas that is directed through the torch body for circulating around the head of the torch adjacent to the electrode tip. The following diagram illustrates the Ternary Gas system:



Options for Commercialization

This technology opportunity is part of the NASA Technology Transfer Program. The program seeks to stimulate development of commercial applications from NASA-developed technology. The Ternary Gas Plasma Welding Torch has been developed, built, and used at MSFC. It is protected under US patent number 5,399,831. NASA seeks qualified companies to license and commercialize this technology.

Contact

If your company is interested in commercializing the Ternary Gas Plasma Welding Torch or if you need additional information, please reference case no. MFS-28857 and contact:

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